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Review Articles

Strength Training as a Countermeasure to Aging Muscle and Chronic Disease

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Abstract

Strength training (ST) has long been considered a promising intervention for reversing the loss of muscle function and the deterioration of muscle structure associated with advanced age but, until recently, the evidence was insufficient to support its role in the prevention or treatment of disease. In recent decades, there has been a long list of quality reviews examining the effects of ST on functional abilities and a few on risk factors for specific diseases, but none have provided a comprehensive assessment of ST as an intervention for a broad range of diseases. This review provides an overview of research addressing the effectiveness of ST as an intervention for the prevention or treatment of the adverse consequences of (i) aging muscle; (ii) the metabolic syndrome (MetS) and its components, i.e. insulin resistance, abdominal obesity, hyperlipidaemia and hypertension; (iii) fibromyalgia; (iv) rheumatoid arthritis; and (v) Alzheimer's disease. Collectively, these studies indicate that ST may serve as an effective countermeasure to some of the adverse consequences of the MetS, fibromyalgia and rheumatoid arthritis.

Evidence in support of the hypothesis that ST reduces insulin resistance or improves insulin action comes both from indirect biomarkers, such as glycosylated haemoglobin (HbA_{1c}), and insulin responses to oral glucose tolerance tests, as well as from more direct procedures such as hyperglycaemic and hyperinsulinaemic-euglycaemic clamp techniques. The evidence for the use of ST as a countermeasure of abdominal obesity is less convincing. Although some reports show statistically significant reductions in visceral fat, it is unclear if the magnitude of these changes are physiologically meaningful and if they are independent of dietary influences. The efficacy of ST as an intervention for reducing dyslipidaemia is at best inconsistent, particularly when compared with other pharmacological and non-pharmacological interventions, such as aerobic exercise training. However, there is more consistent evidence for the effectiveness of ST in reducing triglyceride levels. This finding could have clinical significance, given that elevated triglyceride is one of the five criterion measures for the diagnosis of the MetS. Small to moderate reductions in resting and exercise blood pressure have been reported with some indication that this effect may be genotype dependent. ST improves or reverses some of the adverse effects of fibromyalgia and rheumatoid arthritis, particularly pain, inflammation, muscle weakness and fatigue. Investigations are needed to determine how these effects compare with those elicited from aerobic exercise training and/or standard treatments. There is no evidence that ST can reverse any of the major biological or behavioural outcomes of Alzheimer's disease, but there is evidence that the prevalence of this disease is inversely associated with muscle mass and strength. Some indicators of cognitive function may also improve with ST.

Thus, ST is an effective countermeasure for some of the adverse effects experienced by patients of many chronic diseases, as discussed in this review.